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Manual of Photography

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MANUAL OF PHOTOGRAPHY,

ADAPTED TO

AMATEUR PRACTICE.

WHIPPLE'S ALBUMEN PROCESS.

By GEORGE B. COALE.

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CONTENTS.

PAGE.

PREFACE, ... v

GENERAL OUTLINE OF PHOTOGRAPHY, . . . 3

CHARACTERISTICS OF THE VARIOUS PROCESSES:

THE DAGUERREOTYPE, ... 11

THE COLLODION PROCESS, . . . 11

THE ALBUMEN PROCESS, ... 12

THE CALOTYPE AND WAXED-PAPER PROCESSES, . 14

MANUAL, PART I.

THE OPERATING ROOM, ... 17

CHOICE OF SIZE, ... 19

GLASS, ... 19

PREPARATION OF MATERIALS:

THE NITRATE BATH, ... 22

THE ALBUMEN, ... 23

PREPARATION OF PLATES, ... 25

TIME OF EXPOSURE, ... 31

DEVELOPING, ... 32

INSTRUMENTS, ... 37

OPERATIONS IN THE FIELD, ... 40

PART II.

PRINTING PROCESSES. 47

PAPER, ... 52

SALTING AND ALBUMENISING, ... 53

SENSITIZING, ... 55

EXPOSURE TO LIGHT, ... 58

FIXING, TONING AND WASHING, . . . 61

MOUNTING THE PROOFS, ... 64

THE AMMONIO-NITRATE PROCESS, . . . 66

PRINTING BY DEVELOPMENT, ... 68

THE SEL D'OR TONING PROCESS, . . . 72

POSITIVES ON GLASS, ... 75

TO RECOVER SILVER FROM WASTE SOLUTIONS, . 77

TO REMOVE STAINS FROM THE HANDS AND CLOTHES, . 78

SCHEDULE OF APPARATUS, ... 79

SCHEDULE OF CHEMICALS, ... 80

CONCLUDING MAXIMS, ... 81

PREFACE.

The Art of Photography in this country has been hitherto almost exclusively in the hands of a professional class who have applied it, with very limited exception, to the production of portraits. In Europe it is otherwise. In England, France and Germany, Photography is the recreation and accomplishment of a large circle of amateurs, far outnumbering the professional class, including gentlemen of varied professional and business occupations, and even ladies in considerable numbers. To the energy with which this class have devoted to the art, leisure, wealth and high scientific attainments, it is mainly indebted for the perfection at which it has arrived.

Landscape, Architecture and similar subjects are chosen for the exercise of their skill, and with the facilities now within reach of every one, the tourist may, with a slight addition to his travelling incumbrances, bring home with him the most charming and satisfactory souvenirs of his travel, in views of marvellous accuracy and beauty, painted by Nature herself.

It is the object of this little manual to demonstrate practically that the Art of Photography may be adopted as a most delightful recreation by any one of moderate leisure, and that the most beautiful results are attainable by the exercise of the most ordinary skill if backed by a

reasonable amount of perseverance. The writer has endeavored to describe the manipulations with a minuteness that should amount as nearly as possible in value to an actual performance of them in the presence of the student, and leave no question to be asked. Every thing that the manual contains has been successfully performed by the writer in the manner described, and with as limited facilities as are likely to be possessed by any one who would think of undertaking the art.

Although designed and arranged specially for amateurs, it is hoped and believed that this volume will be found of interest and utility to Photographers generally. The first part is devoted to a beautiful and useful process, which has never before been so fully described in print; and the second part devoted to Printing Processes, has been carefully prepared from considerable study and experience; and may be, it is believed, safely relied on.

Whatever originality this treatise may contain, is too closely interwoven with the instruction which the writer has derived from all the generous contributors to the literature of the art, to need or deserve any special mention. He has endeavored to make the *general* instructions so full as greatly to assist the amateur in the practice of other processes not introduced into this manual, and indeed to make the current journals and treatises immediately useful to him.

GENERAL OUTLINE OF PHOTOGRAPHY.

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The combinations of Silver with Iodine, Chlorine and Bromine, termed Salts of Silver, are chemically changed and become darkened on being exposed to the action of light.

This peculiar property of the Salts of Silver is the foundation of the Science of Photography.

The Iodide of Silver is the most sensitive to the action of light; sufficiently so to receive an impression of the image cast upon the spectrum in the familiar instrument known as the Camera Obscura.

All Photographic processes have in common the object of producing an extremely thin surface-layer or film of Iodide of Silver for the reception of the image which is to form the picture; they differ in the modes by which this is effected, and in the substances used to support the surface-layer.

In the Daguerreotype process the silver coating of a metallic plate is, upon its surface, converted into Iodide of Silver by exposure to the fumes of Iodine.

In the various Paper processes the paper is first treated with a solution of a Salt containing Iodine, such as the Iodide of Potassium, and then exposed to the action of another solution containing Nitrate of Silver. The double decomposition of these Salts from what is familiarly known as "Chemical Affinity," causes the liberation of the Potassium from the one and the Nitrogen from the other, the Iodine and Silver combining to form an Iodide of Silver which is held by the texture of the paper.

The Collodion and Albumen processes are analogous in their mode of procedure chemically. Glass is used as the support of the film. The Salt containing Iodine is dissolved in the Collodion (gun-cotton dissolved in Ether and Alcohol) or in the Albumen (white of egg) which is then poured over the glass, and when properly dried it is dipped into a solution of Nitrate of Silver, whence it issues covered, by the process described, with an extremely thin layer of Iodide of Silver.

This layer is exposed for a certain period to the image in the Camera of the object to be impressed. This exposure is not continued until the image is brought out by the direct action of the light; the layer, however, in a short period undergoes a chemical change in which a *latent* impression of the image is received. This impression becomes visible on the application of certain chemical substances technically called Developing or Reducing

Agents. In the Daguerrian process the vapor of heated Mercury is used. In the Paper and Albumen processes, Gallic Acid; and in the Collodion process the developing agent most commonly used is Proto-Sulphate of Iron. Under the action of the developing agent the image gradually appears; the transparent film becoming opaque where the light has acted upon it, the degree of opacity being graduated by the gradations of intensity in the light.

When the image is fully developed there remains one step more: to render it permanent. This is effected by subjecting it to the action of solvents which have the property of dissolving and thus removing the Iodide of Silver on the film which has remained unchanged by light; while that portion of the film which has undergone the change remains insoluble by it. Cyanide of Potassium and Hyposulphite of Soda possess this quality, and are the solvents universally used in Photography.

There is also a fundamental difference in the character of the pictures produced under these various processes. The chief distinction is that which classes them technically as "Positives" and "Negatives." A Positive is a picture viewed by direct light, as an engraving or drawing. Daguerreotypes and Ambrotypes are termed "direct positives," being produced by a single process, directly from the Camera. A Negative is viewed and used with transmitted light. In a negative all the lights and shadows in

the object represented are reversed; the sky is opaque, and all the gradations of light and shadow in the picture are represented in the negative by gradations of opacity and transparency. The use of a negative is to produce pictures by a secondary process, as follows:

A sheet of paper is first dipped in a solution of a salt containing Chlorine; common salt (Chloride of Sodium) is most commonly used for the purpose. When dry, the paper is floated upon a solution of Nitrate of Silver, and by double decomposition, as before described, it becomes coated with a surface-layer of Chloride of Silver, which will rapidly turn black under the action of light. Upon this surface the negative is firmly compressed and is then exposed to the light. The light penetrating the negative, darkens the paper below more or less as its intensity is modified by the image upon the glass. The higher lights of the picture being densely opaque, of course protect the sensitive surface of the paper from any change whatever; while the shadows, being perfectly transparent on the negative are impressed in a deep black upon the paper. When the impression is sufficiently deep, the paper picture undergoes the "fixing process" before referred to, and the unchanged Chloride of Silver on its surface is removed in a solution of Hyposulphite of Soda. The picture is then finished.

From a negative an indefinite number of pictures may be printed. It is, therefore, obvious that the production

of a good negative is among the highest points in the Art of Photography.

It will be observed that the terms "printing" and "impression" are used only from the analogy in *results* to the art of engraving; the photograph not being produced by impression in the mechanical sense of the word.

This general description is sufficient to enable the amateur to understand and apply the practical details of this Manual.

CHARACTERISTICS OF THE VARIOUS PROCESSES.

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THE DAGUERREOTYPE.

In the Daguerreotype, the finest attainable film of Iodide of Silver is furnished by the highly polished metallic surface on which it is formed. Consequently, this process surpasses all others in the extreme microscopic minuteness of the details of which it is capable of receiving impression. Its usefulness and field are manifestly limited, and it offers no attractions whatever to the amateur.

COLLODION PROCESS.

In this, the highest degree of sensitiveness is attained. The film being soft and wet when exposed in the Camera, is capable of retaining an impression made in a fraction of a second. When skillfully practised to the extent of its capabilities in this direction, it has produced perfect representations of objects in motion, such as a large concourse of persons, and even a horse race and breaking waves. It produces very beautiful positive pictures on glass (Ambro-

types,) and by slight modifications the image is made more dense upon the plate, (technically, more *intense*,) and it becomes a negative for the production of copies on paper as before described. It is universally employed for Portraiture, and is perhaps more generally practised than all the other processes.

The Collodion Process has been very thoroughly described in treatises so numerous and procurable, that any thing upon the subject would be superfluous in this Manual. Hardwick, Hennah and Thornthwait in England, and Humphrey and Burgess in this country are with many others, to be relied on. The chief disadvantage of this process for Amateur practice is, that the entire manipulation must be performed on the spot where the picture is to be taken,* and the consequent necessity of conveying into the field a considerable quantity of chemicals and apparatus, with a dark tent to work in.

THE ALBUMEN PROCESS.

The Albumen Process rivals the Daguerreotype in sharpness of definition. Its dense and dry film is many times less sensitive than Collodion, the latter requiring an expo-

*The writer does not intend to ignore the various "preservatives," which belong to the Collodion Process. Even with the best of these added, however, he considers the method less adapted for Amateur use than the one subsequently recommended.

sure of seconds where Albumen demands minutes; yet it appears to surpass Collodion in the capability of rendering depth and transparency of shadow, and details in shadow contrasted with high light. This process had been long practised and brought to great perfection in France, when Mr. Whipple, of Boston, introduced an important modification, by adding to the Albumen nearly an equal bulk of honey and drying the plates by heat. The result is the production of a film far more sensitive than the simple Albumen, quicker in all the details of its manipulation, and free from cracks, which are a common evil in the French method. It is, under the names of "Whipple's Process," and "The American Process," largely practised in England, and affords, perhaps, above all others, the greatest attractions to the amateur. No other is more capable of being practised in hours of leisure occurring at uncertain periods. Plates properly prepared, retain their virtue for a long time unimpaired; the tourist is encumbered with only his Camera, a box of plates, an exposure frame, and a dark bag in which the plates may be adjusted to the frame, and afterwards returned to the box: the developement after exposure is the work of leisure hours that may be waited for without hazard to the result of the labor undergone. For Landscape Photography it is especially adapted; extreme distance and all the gradations of distance being rendered with wonderful fidelity and beauty.

THE CALOTYPE AND WAXED-PAPER PROCESSES.

The latter of these may be regarded as a modification of the former, which it appears to have nearly superseded. It, also, offers great attractions to the amateur. It is inferior to Whipple's Process in sharpness of detail and in the rendering of distant objects, and is also less sensitive, requiring sometimes a tedious length of exposure. It is admirably adapted for large masses, Buildings, Rocks, Trees without foliage, with details of foreground. It has also the advantage of greater portability; a portfolio of paper being substituted for the box of plates, and an adjustment to the Camera for the exposure frame. With the exception of waxing the paper, an operation which requires care with some skill and experience, the details of the manipulation are so simple and mechanical, as scarcely to admit of failure, except through carelessness and uncleanliness. It requires also a smaller amount of chemicals and laboratory apparatus than any of the previously named methods. It is the invention of Mr. LeGray, of France, who has published a treatise upon it. Several others are extant.

The amateur is recommended to commence with Whipple's Process, to the details of which the rest of this Manual will be devoted. After the attainment of skill in this process, others will be found easy of practice.

MANUAL.

MANUAL.

I.—THE OPERATING ROOM.

The first and an absolute essential to the practice of Photography is an abundant supply of water. In town, a small room adjoining a bath room with a hydrant, or a water tap and sink, is well suited to the purpose. A bookcase about two and a half feet wide with two deep shelves below and five ordinary book shelves above, will contain all the necessary chemicals and apparatus. A small table, three feet by two, and a strip of oil cloth a yard and a half wide, extending from the closet to the table to receive the inevitable stains, complete the Photographer's furniture, which obviously need not interfere with other uses to which the room may be appropriated.

Should a bath room be used for the necessary washings, fill the tub first to the depth of twelve inches, and when the water shows the least discoloration, empty it and fill again. With a little but *constant* care the room may be maintained free from reproach to Photography.

Where water works do not exist, a half cask holding at least twenty-five gallons of water with a spiggot, and a large tub below, are sufficient for ordinary amateur practice.

It is obvious that all operations in preparing or developing the sensitive plates must be performed by a light too feeble to exercise any chemical effect upon them. Daylight transmitted through a *dark yellow glass* is deprived of its actinic power. Gas light, if not too nearly approached nor too long continued, may be used; also sperm candles.

It is safer, however, to shield the flame by a shade colored yellow. This may be done by a coat of varnish in which a little raw sienna is mixed.

To make a dark chamber in the daytime, tack over the window at least four thicknesses of black muslin to totally exclude the light; also, secure the door against a chance opening.

Another requisite is a sufficiently dark place in which to dry sensitive paper prepared for printing. This being not very sensitive, a moderately dark passage will answer. Stretch a string in this upon which to hang the papers and protect the floor by a strip of old matting from the drops which drain from them. Or procure a common packing box two feet long and sixteen inches square at the ends. On the inside of the front and back, nail a small strip about an inch from the top. Ten or twelve sticks resting upon these across the box will hold as much paper as you will ever have occasion to prepare at one time. The box covered with calico and cushioned makes a serviceable piece of furniture.

II.—CHOICE OF SIZE.

What is termed the "French full" size or four-quarter plate measuring eight and a half by six and a half inches, is unquestionably the best for amateur practice, and the one almost universally used in England and France. It is sufficiently large to afford fine landscape effects and small enough, to be in all respects more easily manipulated and more portable than a plate only a few inches larger. All the various papers cut to this size without waste. It is proper to advise the amateur that a small increase beyond this is attended with a large and undue increase of expense.

III.—GLASS.

The glass used should be free from bubbles and scratches, straight and of sufficiently good quality to bear heating and considerable pressure. There is a good German window glass procurable; also a French window glass in sheets, thirteen by twenty inches, which supply plates of the size we have chosen at seventy-five cents per dozen. American window glass is too brittle to be always relied on.

Keep your glass in a box just large enough to hold it dropped in endwise, and provide another to hold glass that is cleaned and ready for use. For the latter a daguerreotype plate box with the grooves enlarged answers the best. They are to be procured cheaply from all the dealers in stock.

Before putting your glass away, give each edge a smart wipe with a coarse file on both sides to take off the sharpness. Cut fingers are an inevitable result of neglect of this precaution.

When they are to be used, the glasses must be thoroughly and chemically clean.

First wash them well in water to remove the adherent dirt and straw, and afterwards either of the following simple treatments will suffice :

Mix :—

Tripoli, - - - -	1 dram.
Nitric acid, - - - -	½ dram.

Water enough to make of it a thin paste.

Rub each side of the glass hard with a piece of canton flannel dipped in this mixture; before it dries, rub it off with a second piece, and finally dry it with a third and larger piece. Or,

Rub each side vigorously with a paste of fine whiting or prepared chalk and water, and allow it to dry upon the glass. They may be kept in this state until they are to

be used, when the whiting must be rubbed off with a piece of canton flannel and the plate polished with a second piece, or with a buff of wash leather. This had better be done out of the room in which the plates are to be coated, dust being a great enemy of that operation. When you have cleaned a glass, examine carefully which is the better side, and deposit it in the clean box with that side to the right. Method in trifles like this will be found greatly to facilitate your work.

When glasses have been used, the albumen film may be removed by a few drops of ammonia rubbed on with a piece of canton flannel, or by leaving them for a short time in a strong solution of common washing soda, or a solution of Cyanide of Potassium, an ounce to a pint of water. After this, wash them thoroughly well under a tap, and if wiped dry immediately, they need no further cleaning.

Cyanide of Potassium is very poisonous taken internally or into the blood. A small quantity is useful for cleaning glass, or removing stains from the hands or clothes. It is used as a fixing agent in the Collodion process only.

IV.—PREPARATION OF MATERIALS.

THE NITRATE BATH.

Formula.

Nitrate of Silver, chrystalized,	45 grains.
Distilled water, - - -	1 ounce.
Acetic Acid, No. 8, - -	2 drams.

The Nitrate of Silver to be saturated with Iodide of Silver.

Supposing about 20 oz. of the above formula to be sufficient to fill the vessel in which the plate is to be immersed, make that quantity in the following manner:

Dissolve 720 grains of Nitrate of Silver in 15 oz. of distilled water.* Dissolve 7 grains of Iodide of Potassium or Iodide of Ammonium in one ounce of distilled water, and add it to the solution of Nitrate of Silver. A dense yellow precipitate is immediately formed which is Iodide of Silver. Put this mixture into a bottle and shake it frequently. In a short time nearly all the Iodide of Silver will be re-dissolved, and the solution will subside clear. Then

* All solutions of Nitrate of Silver should be made in distilled or very pure rain water. Salt, lime, and organic matters existing in most river or spring water would discolor the solution and precipitate the silver.

add 4 ounces of Acetic Acid No. 8. It is necessary that this power of Nitrate of Silver to dissolve Iodide of Silver be saturated, or it would attack the new made film on the plate when dipped in the bath. It is not necessary to filter this bath. It will turn very dark after a short using, but this is of no moment.

The most convenient dipping bath to be procured is one made of Queensware, measuring eight by ten inches, and so narrow that eighteen ounces of solution fill it when a plate is immersed. It is furnished with a sharp beak from which the solution can be easily poured back into the bottle, to which it should always be returned after using. Lewis' Glass Baths are very complete, but are unduly expensive, both in cost and in the large quantity of solution required to fill them. Gutta percha baths are not to be relied on.

THE ALBUMEN.

Formula.

Albumen, - - - -	1 ounce.
Syrup, - - - -	$\frac{1}{2}$ ounce.
Iodide of Ammonium, - -	12 grains.
Bromide of Ammonium, -	5 grains.

The syrup is made thus:

Dissolve one pound of white sugar in half a pint of water, place it upon the fire until it comes to boiling heat and instantly remove it.

Prepared Albumen will not keep longer than six or eight days. A fermentation then commences that immediately destroys it for use. It must be prepared as needed. Five ounces, a convenient quantity, may be prepared thus:

Provide four large, fresh eggs. Break an egg by a smart blow on the side against the edge of a wine glass, and drop the white into the glass. By splitting the shell into two halves in this way, the membranous cords that attach the yolk to the inner membrane of the shell (commonly miscalled "germ") will adhere to them. Should these cords detach themselves, they will appear as a white opaque body in the Albumen, and must be carefully hooked out by means of a small wire or toothpick; the pure Albumen is then poured into a measuring glass. When each egg has been treated in like manner, you will find about four ounces of Albumen in the glass. Now dissolve the requisite portion of the salts—say, for four ounces, forty-eight grains of Iodide of Ammonium and twenty grains of Bromide of Ammonium, in the smallest sufficient quantity of clean water, say about two drams. When it is thoroughly dissolved and no suspended particles are visible,

add it to the Albumen, and lastly add two ounces of syrup made as above described.

Put the contents of the glass into a bowl, and with a silver or wooden fork, or common wire egg-beater, beat it to a stiff froth. It is necessary and sufficient that the whole should be frothed, or it would subside ropy. Cover the bowl to protect it from dust, and set it away for twelve hours to subside. Lastly, strain it into the glass from which it is to be used through fine cambric doubled, or fine flannel, wet, or (best) through fine miller's bolting cloth stretched over a napkin ring or wide funnel. An eight ounce wide-mouthed bottle, or a four or six ounce measuring glass, is a convenient vessel from which to use it. After straining, it must stand for a few hours that all the air bubbles in it may be dispersed. *Air bubbles are the greatest enemy of this process.* They do not form upon the plate *if it be clean*, but when they appear, have come in the Albumen from the glass. Dust is also a great enemy.

V.—PREPARATION OF PLATES.

Do not permit your room to be swept on the day you intend to prepare plates, but sprinkle the carpet with water. Wipe off your table with a damp sponge. Place your leveling stand in the middle of your table and beneath it

a large dish. To the near edge of the dish fasten a sponge moistened with water. On the right of the dish stands the glass containing the prepared albumen, on the left a spirit lamp and a bowl. The Nitrate bath stands beside the bath tub or water sink, a newspaper spread below it to catch the inevitable drops. Across the bath tub (which is half full of water) lay two sticks, one thicker than the other, to hold the plate in an inclined position while being washed. Two feet of half-inch India rubber hose are attached to the hydrant to direct the stream more conveniently and to moderate its force.

These preparations made, sit at the table. Draw a clean glass from the box and dust the side you have selected as the best with a camel's hair brush or silk handkerchief. Lay it upon the leveling stand or balance it upon the tips of the thumb and fingers of the left hand thrown up in the form of a funnel. Holding the albumen bottle in the right hand, the thumb across the mouth, so that the liquid trickles from the orifice below, pour steadily a small stream into the centre of the glass until a circle of about five inches diameter is formed. Tilt the plate gently toward each side until the Albumen has run to the edge. Now lay the plate upon the levelling stand and search carefully for air-bubbles that may be suspended in the film. If any are discovered touch them with the end of your glass rod or the tip of the finger to break them. When this is done raise the plate to a vertical position to allow the superfluous albumen to flow

from it. Do not *drain* it, but when the stream changes to rather slow drops (in about five seconds) wipe the lower edge of the plate across the sponge and lay it again on the levelling stand for half a minute to allow the coating to equalize itself as nearly as possible. Light the spirit lamp, pick up the plate by opposite corners, the thumb and forefinger of each hand pressed against the edges, and pass it steadily back and forth over the flame of the lamp; the flame being in contact with the glass. Commence at the side opposite that from which the plate was drained and hold the plate as horizontally as possible. After a few seconds, drain the plate from the lower corner into the bowl—*not into the dish*. Drops of liquid will run rapidly from it. Wipe the edge again on the sponge and continue the drying in this manner until the lower edge of the plate is *tacky*, and you can touch the corner from which you have drained it without bringing away any of the film. Set it aside, face to the wall, and proceed in like manner with a second plate.

It is extremely difficult to obtain a film of entirely even thickness all over the plate. There will be necessarily an increasing density towards the edge from which you drain it; and where the film is more dense the negative will exhibit a more intense developement. This feature you may turn to advantage by always exposing a plate in the camera with the drained edge *down*, so that the sky of the landscape, the part that requires great intensity, will fall upon it.

You will bear this in mind in preparing plates, and provide a due proportion of both kinds, vertical and horizontal, by draining some from the end and some from the side.

When you have brought the second plate to the same stage as the first, set it against the wall. Take up No. 1 again and pass it over the lamp until the finger may glide over the lower edge without sticking. Then while still warm (only not hot enough to break on touching the bath solution) set it in the dipper and with one steady motion lower it into the bath. The least hesitation, receding or jarring against the sides, will streak or crack the film and render the plate useless.

Leave the plate in the bath 25 seconds—this is sufficient, but a minute will do it no injury.

On coming from the bath the plate is covered with a pearly blue or opalescent film. In this stage it is easily broken or wiped from the glass. Drain it an instant over the bath and then dip it into the tub and wash the back free from any thing that may adhere to it. Now examine whether the film be a good one or defaced by cracks or other blemishes. If it be acceptable, lay it upon the sticks placed for its support and carefully wash it by passing the stream from the hose over every part of the surface. The object of this is to remove every trace of free Nitrate of Silver, which, if allowed to crystallise on the film, would cause it to turn black in development. It will require about two minutes washing to do this effectually, and the

best test of its accomplishment is, that you can drain a drop from the surface of the plate upon the tongue without tasting the aceto-nitrate.

When thoroughly washed set the plates aside to dry. When dry, the film has become a transparent pale blue in color and very hard. It is somewhat difficult to distinguish the coated side of the glass. Deposit the plates in your exposure frames, or in your dark box. If in the latter, place the coated side facing the back of the box; the drained edge of the horizontal plates down, and that of the vertical plates to the right hand, having first attached a small piece of gummed label to the back of each plate at the edge opposite the drained one, to enable you to distinguish the coated side by feeling in the dark.

It is well to prepare plates by twos or threes, as above described. They appear to be more effectually dried by a resumption after the interval of a few minutes. If dried *too long* before they are dipped, they become covered with blisters under the washing.

To prepare six good plates is an hour's work.

You will find that about half an ounce of Albumen has been poured on each plate—a guide as to the quantity to prepare for any occasion. That which has been drained *into the dish* may be poured through your filter back into the glass, and will be ready for use again as soon as the air bubbles disperse. That which was drained into the bowl, after passing over the lamp, is useless.

Return the Nitrate Bath Solution to the bottle and add to it two grains of Nitrate of Silver for each plate dipped, to keep it to its original strength. When reduced by evaporation add a mixture of two parts distilled water and one of acetic acid to make up the original quantity. If the bath becomes weak in silver, the film will crack in the direction of the dip immediately on being immersed.

Plates properly prepared and *conscientiously washed* may be relied on for at least one month, if kept absolutely free from light, moisture, or deleterious atmosphere. Fresh paint or varnish near them, or the fumes of ammonia, will rapidly destroy them.

In concluding this chapter, the writer would especially caution the amateur against being disheartened by repeated failures in his first attempts to procure good plates. This is certainly the only step in the process that presents peculiar difficulties that must be overcome by sheer perseverance with the exercise of patience and judgment. When attained, the exercise of the *skill* requisite for success in this process will impart to it an attraction which the more mechanical and "infallible" methods lack.

VI.—TIME OF EXPOSURE.

It is obviously impossible to give any rule by which to determine the time that a plate must be exposed in the Camera, as this must vary both with the varying conditions of the light as to color and intensity, and with the character of the object to be impressed. Experience and methodical observation will, however, lead to something approaching infallibility of judgment on this point.

The writer has found the following points to be good standards, from which to estimate. With a $2\frac{1}{2}$ inch single lens, 13 inches focus, and $\frac{1}{2}$ inch aperture, for a landscape of hill, rock, water, trees with little or no foliage, in full sunshine, six minutes. With passing clouds, about $4\frac{1}{2}$ of cloud, and 3 of sunshine. For foliage in sunshine, full 10 minutes. For a stone building in sunshine $3\frac{1}{2}$ to 5 are sufficient.

Under-exposure cannot be remedied. Over-exposure to a certain extent may be; or rather, to speak more accurately—a certain amount of exposure is absolutely necessary to impress an object, and if this be wanting, no forcing in the development can bring out the image which is not impressed—but, the requisite time having been given, there appears to be then a margin of time through which it may be continued without injury to the final result, it being possible to arrest the development at a point which

leaves a perfect negative. If the exposure be carried still further, the development will proceed with great rapidity, and before any half tones appear, the distance will be lost in the sky, and all detail in the high lights obliterated, the negative assuming by direct light the appearance of a daguerreotype.

More will be said on the subject of exposure in the chapter on operations in the field. We will suppose the plate to have been properly exposed, and proceed to describe the mode of development.

VII.—DEVELOPING.

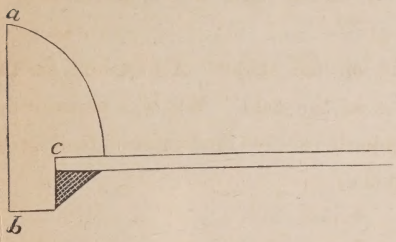
Prepare the following solutions:

No. 1. Gallic Acid—a saturated solution in *soft* water.

Put 2 drams or more, of Gallic Acid into a pint bottle and fill it with water to the cork, so as totally to exclude the air. Gallic Acid in solution rapidly decomposes if exposed to the atmosphere; it is therefore necessary always to keep the bottle full in the manner described. When it is to be used, filter about $2\frac{1}{2}$ ounces for each plate to be developed, and re-fill the bottle. A dram will saturate from 12 to 15 ounces of water.

No. 2.	Nitrate of Silver, - -	100 grains.
	Distilled Water, - -	5 ounces.
	Acetic Acid No. 8, - -	2 drams.

The plate to be developed may be levelled upon a levelling stand, or, which is much more convenient, held in a shallow dish or tray made in the following simple manner:



Section of a Side.

Make a frame of moulding of the above pattern *a. b.* of dry walnut or cherry, $8\frac{5}{8}$ by $6\frac{5}{8}$ inches, *sight measure.* The joints must be dovetailed and glued to prevent leakage, and the whole frame well varnished with shellac. Into the rabbit *c.* a common glass is set with shellac, and fixed with tacks and putty like the glazing of a window. This gives a shallow dish with a transparent bottom $\frac{1}{8}$ of an inch each way larger than your plate. It will require little more solution to flood the plate than if it were on a levelling stand, and by means of it the plate can be more nicely handled and developed perfectly to the edge. It is well to have two or three of these trays, as they are cheaply made and can be put to several uses.

When a plate is to be developed, your dish must be made scrupulously clean. Spread a sheet of white paper upon the table before you and lay the dish upon it. Having first

wet the exposed plate, place it in the dish, with the Albumen side upwards. Pour over it a sufficient quantity of the solution No. 1 to cover the plate well. After it has remained on the plate one minute, pour off the Gallic Acid into a small pitcher or measuring glass, and add to it about one dram of solution No. 2. Upon pouring the mixed solutions back upon the plate, the development will almost immediately commence. The high lights, first the sky, will rapidly darken, and gradually the whole picture will appear.

The plate during development must be watched attentively. The light of your lamp against the white paper under the frame is the best relief over which to inspect the progress it is making and the degree of intensity attained. It is advisable not to be too precipitate in endeavoring to hasten the work by an over-dose of silver. It is a safe rule (at least until considerable experience is attained) to keep down the quantity of silver to the smallest that appears to be carrying on the development by a progress that you can mark from minute to minute. When the silver is in excess, the solution rapidly becomes black, and much is precipitated in a metallic form on the plate. When this precipitate appears, stop the process of development; wash the plate under a tap, and with the surface well floated with water, rub the deposit of silver off gently with the ball of the finger, taking care that it be perfectly

clean. In this manner all that would injure the negative may be removed.

If long black opaque spots like notes of exclamation appear early in the process of developing, they are *probably* an indication that the plate was not thoroughly washed in preparing it. They generally run in the direction in which the plate is dipped. Small round dots of metallic silver often appear. They may be rubbed off in the manner above described. The writer has never discovered with any certainty the cause of these two kinds of blemish.

To ascertain when to stop the development: As a general rule, the full appearance of a half tint, such as details on a shadow, is a sign that the development is complete. While your plate was being exposed in the Camera, you will have noted well and made memoranda of various points in your subject which contain such details as may guide you with certainty on this point.

When finished, pour off the solution; wash the plate on both sides under a tap, and immerse it in a solution of

Hyposulphite of Soda, - - 6 ounces,
Common Water, - - 12 ounces,

until the blue tint of the Iodide of Silver disappears, which will be in five or ten minutes—a longer time would not injure it, but it is useless. The negative is then well washed on both sides under a tap and stood aside to dry.

When dry, the film is very hard and needs no varnish to protect it.

A clean, well developed negative is of itself a beautiful object. The sky should be so intense that the flame of a candle is dimly seen through it. The rest of the picture, when seen by transmitted light, over a white surface, appears of a pale olive tint, the details being marked out with great sharpness of line. Each negative should be wrapped in a sheet of soft paper, labeled on the outside with the name of the view, and such memoranda of the circumstances under which it was taken as may be useful for reference.

Forcing and Re-development.

An over developed negative is irretrievably ruined. If after fixing in the Hypo, it be found not sufficiently intense, it may still be strengthened.

Wash it thoroughly under a tap to remove every trace of Hypo, or if it has been dried, to wet the surface so that the developing solution may flow instantly over it. Hold the dish containing the plate in one hand in order that you may pour off the solution the very moment it has covered the plate. Use an ounce of fresh solution for this purpose, with very little silver—not over one dram of the solution No. 2. Pour it on and off rapidly, as directed, and look for the result before repeating the operation. It will, most probably, be found increased in intensity to a remarkable

degree. There is indeed some danger of over-shooting the desired point, even on a single application of this method; sometimes, however, several may be needed; and perhaps the negative may be ruined by being turned a deep yellow color without the details of the picture being sharpened.

The phenomena presented by this rapid and peculiar action of the developing solution *after fixing*, are worthy the attention of persons more skilled in the chemistry of the art than the present writer. He is unable, after many successful and unsuccessful applications of it, to reduce the results to anything like a rule for its invariably *safe* use. He has sometimes by means of it improved a weak and apparently under exposed negative, to a superb perfection, and has also destroyed some that were fair. Two points are certain—the blue tint of the Iodide of Silver must be entirely removed, and every trace of Hypo washed from the plate before it is tried. The deep yellow tint to the negative, before spoken of, appears to proceed from the presence of Hypo.

VIII.—INSTRUMENTS.

It is to be regretted that so little of the apparatus adapted peculiarly to the amateur practice of Photography is supplied, as yet, by the manufacturers of the United

States. Until very recently neither a field Camera nor a landscape lens was to be found. Mr. Harrison, of New York, now furnishes landscape lenses* of the very first quality, and portable field Cameras of an excellent model are made in the establishment of Anthony of the same city. The English and French Catalogues exhibit a great variety of apparatus, illustrated by wood cuts, the prices being generally, to appearance, very moderate.

The Camera stand should be what is called a double tripod. Any clever instrument maker can furnish them.

For a morning's excursion for six views or less, it is the most convenient plan to have as many separate exposure frames with a prepared glass in each. The slides of the frames should be secured against accidental withdrawal by elastic India rubber bands or a string. Each frame should be numbered on the back. For an excursion of any duration, or a larger number of views, a plate box is necessary to carry the supply of prepared plates. The box should be made of light wood; the plates slide in end grooves, the longer side downwards; the box should be half an inch deeper than the width of the plates, affording room for an inner moveable top like a tea-caddy. The

* In this country (and here only) the dealers in stock call the lens a *Camera*, and the Camera is called a *Box*. The misnomer is not only absurd and disreputable, but may lead to awkward mistakes. *Camera* is Italian for *Chamber*—and a *Lens* is a *lens*, whether applied to a Camera or a Spy-glass, &c.

inner top should be furnished with a spring in the centre which serves for a handle, and also to hold the plates compressed in their places when the outer top is closed.

A dark bag is also necessary in which to transfer plates from the box to the frames. Make it thus:—Cut a triangle three-fourths of a yard on each side, in a treble thickness of common black muslin; this forms the bottom of the bag. To two of the sides sew a strip of four thicknesses of the same material, about four or five feet in length. To the third side sew the same thickness of dark orange calico. Sew together the edges of the strips and run a drawing string around the top of the sack thus formed. To use it:—Deposit the box and frames in the bag. Take a low seat with the bag between the knees. Pull the mouth of the bag over your head and draw the string tightly under the arms. You will find abundant room, and light sufficient through the yellow strip to perform the operation. It is obviously necessary to do this in a shady spot.

A piece of common black cotton velvet about a yard by a yard and a quarter, is needed to shade the ground glass of the Camera while adjusting the focus. Or the following more convenient substitute may be used: To the lower edge of the frame of the ground glass attach by a leather hinge a mirror set upon a sufficiently stout pasteboard. The sides must be attached to the sides of the frame by

pieces of flexible leather to permit it to open like a pocket-book at an angle of 45 degrees. Lay across this open pocket a piece of pasteboard with an eye hole in the centre, and through this, upon the mirror, you will see your view righted from the inversion of the Camera. When not in use, the mirror buttons to the frame of the ground glass. The eye hole may be fitted with a lens, by the assistance of which you may draw a sharper focus than by the unaided eye.

A stout knife or small hatchet is often needed in the field to clear away an intervening bush or bough that may obstruct your view from its best point.

IX.—OPERATIONS IN THE FIELD.

It is unnecessary to say anything here upon the choice of subjects. This must be left to the taste and experience of the Photographer. Very little of the latter will teach him that many views that are charming to the eye are wholly unfit for effective representation by this art; and, on the other hand, that often rude and unpromising subjects present in a Photograph a beauty and even at times a sentiment and interest which of themselves they appear not to possess. These general maxims will be found servicable.

Spare no pains in selecting for a desired view the most favorable *hour of the day*—such an hour as will give the lights and shadows of your subject in the happiest and most characteristic disposition. Remember that you paint your subject in *light and shadow only*. Carefully and not too quickly select your *point of view*. It is not a little mortifying to find, while your plate is being exposed, a spot only a few yards distant from the position of your Camera which would have afforded manifest advantages over the one hastily selected.

It is obvious that the Camera should not face the sun. Not only because diffused light may thereby enter the lens to the injury of the sensitive film, but a little observation will show the disadvantage of having the shaded sides of all objects fronting you in the picture.

Having selected your point of view, first plant the Camera stand firmly, one leg set rearward at right angles to the plane of your picture, the plate upon which the Camera rests being carefully levelled. This is accomplished by shifting the rear leg only. Place the Camera upon the stand and screw it down firmly. Select some prominent object in the centre of the field and in middle distance, and with the open lens, the diaphram being removed, adjust the focus upon this object as sharply as possible. Upon replacing the diaphram with half inch aperture, you will find that all other objects in the field

are brought into the same focus. Lastly, adjust your view properly in the field of the Camera by turning it slightly to the right or left, and arranging the sliding front to give the desired proportion of sky and foreground, having marked upon your ground glass in strong pencil lines the size of your plate as exposed in its vertical and horizontal positions.

By marking upon a stick a length which when held at arm's length before you exactly measures upon the horizon the extent of field which your Camera will contain, you may save yourself the trouble of frequent removals of the Camera to find the point where the desired picture will be brought within its field.

A half inch aperture to the lens is the largest that should be used for a landscape of any depth Should there be very strong high lights in the picture, such as bright rocks, water, or stone buildings in strong sunlight, contrasted with foliage or masses of detail in shadow, in order not to overdo the high lights before the half tints are impressed, it is advisable to use a smaller aperture with corresponding increase of *time*. The rays of light from objects in shadow do not appear to be reduced by the small aperture in as great a ratio as those from objects in sunlight.

The most favorable light is unquestionably that given under passing clouds. By closing the Camera when necessary, and re-opening it, thus using a due proportion of

sunlight and the diffused light through the cloud, the happiest results may be arrived at.

While your picture is being exposed, examine the details of your view carefully and impress them upon your memory to assist your judgment in the developing process. It is advisable to make pencil memoranda of these, together with notes of the hour of the day, character of light, time of exposure, &c., which will be found of excellent service for reference.

Carefully secure with an India rubber band or string the slide and door of your frames against a chance opening.

PART SECOND.

PRINTING PROCESSES.

PRINTING PROCESSES.

Having accomplished the production of a negative, the next step in the art is to produce the picture from it. As before stated, the picture on paper is formed on a surface of Chloride of Silver furnished to the paper and held by its texture. Upon this surface the negative is laid and firmly compressed, and then exposed to the action of light, which penetrating it in the degree permitted by the image on the negative, impresses this image by blackening the Chloride of Silver. The paper is then immersed in a strong solution of Hyposulphite of Soda; this fixes the image by removing all the remaining Chloride of Silver which has been unchanged by the light, and is therefore still sensitive.

Now, in this fixing process, the appearance of the picture undergoes a very great change. Almost every picture presents a very beautiful appearance when the negative is first removed: but upon the necessary immersion in the Hypo solvent, this delicate dark purple drawing is converted into a dull and dingy red picture—losing the brightness and clearness of detail that constituted its charm when it first met the eye of the operator. Hence, in connection with

the operation of "fixing," must be performed that of "toning," or imparting to the picture an agreeable color, and preserving its details in clearness and permanency. To this end, a great variety of methods or "Printing Processes" have been invented; the ultimate character of the picture being modified in all the stages through which it passes by the quality of the paper, the salts used in preparing it, and those used in imparting its last finish.

As the object of this Manual is merely to accompany the amateur until he is fairly afloat in the practice of Photography, the writer will not undertake to discuss the merits, or go largely into the description of many of these processes, but will select two or three of those most extensively used, that are easy of practice and reasonably certain in their results; at the same time advising that no branch of the art will be found more attractive as a field for experimental excursion or for serious scientific application, than this.

MANUAL.

MANUAL.

Provide at least four porcelain or gutta-percha trays; or, better, two of each material—measuring 9 by 7 or $7\frac{1}{2}$ inches. Also several dozen clothes pins or wood "clips" of two kinds, to be found in all the wooden ware stores, one that is furnished with an India-rubber ring for a spring, and one kind with a strong wire spring. The former are to be used for hanging up papers to dry. Into the top of each drive a pin firmly, and bend it to a hook. Keep in separate boxes those used to hang up papers from the Nitrate of Silver solution, and those to hang up salted papers or finished pictures to dry. The wire spring pins are used to compress the negative to the paper in exposing to light.

We will now proceed to the details of printing in the following order:

1. Selection of paper.
2. Salting, or Chloriding; including the process of Albumenising.
3. Sensitising.*
4. Exposure to light.
5. Toning and Washing.
6. Mounting the proofs.

* To sensitise: a "verb photographic" coined for the use of the art.

I.—PAPER.

The first point upon which judgment and taste are to be exercised, is in the choice between plain and Albumenised-papers. Landscapes upon plain paper possess more of the characteristics of fine drawings in India Ink or Neutral Tint. They appear to be preferred by the English Amateurs, who regard them as more artistic and expressive. Prints upon paper which has received a fine coating of Albumen surpass them in sharpness of details, and in brilliancy of color. They present a highly glazed surface, and are ascertained to be more permanent than prints on plain paper. The Photographers of France and Italy appear to use it almost exclusively.

Of all the various kinds of paper offered for sale in this country, the Saxony Paper (*Papier Saxe*) will be found the most invariably good in quality and free from defects. It gives the best results when used plain, and is also excellent for Albumenising. It is procured in sheets measuring $17\frac{1}{2}$ by $22\frac{1}{2}$ inches, cutting into six pieces of the size adapted for our negatives, with a small margin. The papers of Marion and Canson are good in quality, but the writer has never seen in the Photographic Depots, a sheet of either plain or Albumenized French Paper, which was *entirely* free from blemish. All that comes to this country seems

to have been picked over. Occasionally a small lot of Albumenized paper of superior quality is specially imported. The best of these may be very closely imitated, and at a much smaller price, by the use of the formula given below.

Reject all sheets of paper or parts of sheets in which black specks appear.

II.—SALTING AND ALBUMENISING.

The salts used for Chloriding paper are: Chloride of Ammonium, (Sal-Ammoniac,) Chloride of Sodium, (Common Salt,) and Chloride of Barium.

Of these, the best for general purposes is the Chloride of Ammonium, as being of a more uniform strength and purity than common salt. The Chloride of Barium is used specially in one process to be described. They are of different strength; the equivalents being about 10 grains of Chloride of Ammonium to 11 of Chloride of Sodium, and 22 of Chloride of Barium.

Plain Paper.

In 20 ounces of pure water, dissolve 20 grains of best gelatine, and 160 grains of Chloride of Ammonium or Sodium. A portion of the water must be heated sufficiently to dissolve the gelatine. Filter the solution through

paper into one of your trays to the depth of half an inch or more. Immerse the papers one at a time, until half a dozen or ten are immersed. Turn the whole over, and take them out in the order they were immersed, and hang them up to dry. *In all manipulations of paper, the fingers must be chemically clean.* It is better to handle them when immersed, by the wooden clips, using the point of a tooth-pick to lift the edge out of the solution and attach the clips.

When dry, examine each sheet carefully to select the smoothest side, and mark the other side with a pencil cross in two corners. Keep them dry, and they may be preserved any length of time.

Albumenised Paper.

Formula—Albumen,	- - -	8 ounces.
Pure water,	- - -	4 ounces.
Best Gelatine,	- - -	12 grains.
Chloride of Ammonium,	-	120 grains.

Separate the whites of the eggs, and remove the fibrous parts as before described, and beat them to a stiff froth—add to them the Chloride of Ammonium and Gelatine dissolved in the water, (which must be heated to dissolve the Gelatine,) and beat the whole for five minutes longer. Set the bowl aside for five or six hours, out of the dust, to subside. Filter the whole into the porcelain dish in which

it is to be used. The dish should be a little larger than the papers.

Give the papers a semi-circular bend by rolling them up smoothly for a few moments. Attach two of the wooden clips to one edge of a sheet, holding it bowed from you. Set the opposite edge gently upon the surface of the Albumen, and against the side of the tray, and steadily roll the sheet down upon the surface until the clips nearly touch it. Then immediately by a reverse of the same motion, draw it back from the Albumen, (rather slowly to avoid streaks,) and hang it to dry out of the dust.

Before each sheet is laid down, examine carefully that there are no air bubbles on the surface.

When dry, lay the sheets in a pile between boards, under pressure, or between the leaves of a large book, and they will soon become flat. Keep them dry, and they will not deteriorate.

III.—TO SENSITISE THE PAPER.

This operation does not require such an absolute exclusion of actinic light as the preparation of plates. It may be performed behind a thick window curtain.

The tray used for holding the solution of Nitrate of Silver must be kept for that purpose exclusively. Wash it before and after using it and wipe it dry with a towel.

Dissolve 500 grains of Nitrate of Silver in 10 oz. Distilled Water. Always filter this solution into the tray before using it. Float the papers upon this bath, the unmarked side of the plain papers down, for three minutes for plain and five minutes for Albumenised paper. Be careful in laying down the sheet that no air bubbles are caught under it, and that the back is not wet. The Albumen is coagulated immediately on contact with the solution, and remains perfectly flat; the plain papers will curl up for a few moments. They must remain three minutes after they become flat.

When the sheet has lain upon the bath the sufficient time, lift one end out by the point of a quill and attach a clip to each of the two corners. Lift it off by the clips, and after draining it a moment over the tray, hang it in the dark to dry. When it has hung for a few minutes, remove the drop at the lower edge by touching it with a piece of blotting paper.

The solution becomes soon discolored, especially when used with albumenised paper; it may, however, be used until it becomes of a deep claret color without giving a permanent hue to the paper. It may be cleared by putting into the bottle about a table-spoonful of animal char-

coal or kaolin, leaving it a few hours, and then filtering it. Kaolin must be used if the solution is to be used again with Albumen paper, as the animal charcoal renders it unfit for that paper; the Albumen film decomposing and running in a white stream from the paper when floated on it.

The solution also becomes weakened in silver by every sheet sensitized upon it, and it is necessary to add occasionally small quantities, so as to keep it sufficiently strong. It is mistaken economy to make too much Nitrate of Silver solution at a time, or to use it when it has become both weak and discolored. Your prints will have a *mealy* look and will not tone well. Put such a solution aside to reduce the silver from it, as will be hereafter described, and prepare a fresh quantity.

Another method of sentitizing paper, more expeditious and in some respects more convenient than the preceding, but also much less economical, is as follows:

Make the solution of Nitrate of Silver 60 grains to the ounce of water, and add to it half its bulk of Alcohol. Any paper will flatten instantly on this and will sink below the surface. The paper also becomes transparent, and any air-bubbles under it are instantly detected. Half a dozen papers may be immersed at once and removed in three to four minutes if heavily Albumenised, or in one minute if the paper is light. This solution will not discolor, or only to a slight extent.

Prepared paper will, after the lapse of 12 to 24 hours, begin to turn yellow in the dark. Albumen paper does not discolor so rapidly as the plain. Both are better used as soon as possible after they are dry.

They must be *perfectly dry* before they are used, or the negatives might be injured by contact with them.

IV.—EXPOSURE TO LIGHT.

Printing frames are to be purchased at all the Photographic Depots, which explain their own use. They are so constructed that the picture may be examined while being printed without being displaced from the negative.

The following method answers the same purpose in a a more economical manner:

Lay the prepared paper upon the negative, (the Albumen side of the negative and the prepared surface of the paper, of course, in contact); next to the paper lay about 20 separate leaves of soft paper of even texture, or two or more pieces of soft felt cloth or velvet, cut to the exact size of the negative; next a sheet of smooth writing paper, and lastly another glass, the size of the negative, as a back to the whole. Let the glass back be pushed from the lower edge of the paper about one-twentieth of an inch, or just far enough to enable you to pinch the papers and

negative with the thumb-nail and finger. Attach one of the wire-spring clothes-pins to each corner, and your negative is prepared for exposure. To examine the progress of the picture without displacing it:—Remove the pins from one end and lay it face downwards upon a table, the other end with the pins attached projecting an inch beyond the edge. Hold down the back glass with the left hand while with the right you remove the remaining pins and pinch the negative and papers with the fore-finger and thumb-nail. Upon the smooth sheet of paper you can now slide the back glass an inch from the edge, and upon the margin so uncovered attach three of the pins with as deep a bite as they will take. You may now examine your picture to within an inch of the margin, as you would turn over the leaves of a book. In replacing the back, slide it up to the pins and hold it there firmly before you remove them. The rest of the process is obvious. To return to the exposure to light—

If the negative be not so intense as to *require* direct sunlight to print, it is much better to expose for a sufficiently long time to the diffused light of the sky, than for the much shorter time in the sun, in which the same degree of darkening would be reached. The reduction of the Chloride of Silver appears in the former case, to be more complete, and the print bears better the after process of toning.

The exposure must be continued until the print is very much darker than it is to appear when finished, the fixing solvent having the property of reducing its intensity to a great degree. The exact degree to over print must be learned by experience. It may generally be carried to the entire loss of half tones, and such parts as details in shadow or foliage.

Albumen prints color to a deep lake or maroon color. Plain papers to a reddish purple. If the paper appears spotted, and unevenly darkened, it is an indication that the Nitrate of Silver solution was too weak, or that the paper was floated too short a time.

It frequently happens, that one point in a picture is from its nature so intense as to require a degree of exposure to bring it out that would greatly overdo the rest of the picture—such as a white or granite building, or piece of white rock. In such cases first print to the depth required for the deepest shadows and half tones; then cut out of a piece of dark paper larger than the negative, a hole about the size of the object in high light which is to be brought out. By laying this over the negative, the sunlight may be allowed to fall only on the desired point, and by keeping the paper in motion, the edge will not make a line upon the picture. Another method is to concentrate the sunlight by means of a large reading lens, upon the intense points of the negative, taking care that the focus is not

drawn sufficiently sharp to burn the paper. The small circle of concentrated light, managed by a steady hand may be made to bring out details that could be forced in no other way.

When your pictures have been properly exposed, they may be fixed at once, or laid aside in a dark drawer, without injury, for twelve or fourteen hours.

V.—FIXING, TONING AND WASHING.

The most active toning agent in use, is Chloride of Gold. It is sold in small bottles of 15 grains. The most convenient way to keep it is, to dissolve the contents of a bottle in 30 drams of distilled water; each dram containing half a grain in solution, it is thus more easily measured in the small quantities in which it is used, than it could be by weight.

The operations of Fixing and Toning may be performed in a single bath. The one in most common use, is composed as follows:

Hyposulphite of Soda, - -	5 ounces.
Chloride of Gold, - - -	5 grains.
Nitrate of Silver, - - -	30 grains.
Water, - - - - -	10 ounces.

Particular attention must be given to the manner in which this bath is mixed. The Hypo must be dissolved in a portion of the water, and the solution of Chloride of Gold poured into it—the solution of Silver in the remaining portion of water being added last.

Remember, that in all combinations of Chloride of Gold with Hyposulphite of Soda, the Gold *must be added to the Hypo, the latter being largely in excess;* if the reverse method be pursued, on the contact of a drop of Hypo solution with the Chloride of Gold, the Gold would be instantly precipitated, and the solution worthless.

The bath need not be filtered. Pour it into a tray, and immerse the prints, one at a time, taking care that the surface is quickly and entirely covered, and no air bubbles rest on the surface. The first action of the bath turns the print to a dingy red. After a few minutes the toning process begins, and the print passes through several stages of color. Albumen prints pass through a red-sepia and chocolate brown, to a rich velvety purple. Plain papers through dark brown to the tone of an India ink drawing.

When the desired tone is reached it is well, though not always necessary, to place the print in another solution of plain Hypo 6 ounces to 12 ounces of water, for five or ten minutes. It assures the thorough removal of the Chloride of Silver from the paper. It sometimes happens that the

print is toned before this most important result is accomplished, and the paper turns a mottled gray on exposure to the light.

For Albumen prints, the writer recommends a simpler method than the bath just described. Keep in each of two pint bottles a solution of Hypo, 6 ounces to 12 ounces of water. To one of these add a single grain of gold. This will be found sufficient to tone a considerable number of prints. When it begins to work slowly add another grain of gold, and keep the bottle constantly replenished with solution of the original strength. Transfer the print to the plain Hypo as soon as the desired tone is reached — five minutes immersion will ensure clear white, and effectually remove the cheesy tint which otherwise obtrudes itself in the high lights on Albumenised paper. With a little practice exactly desired results may be thus secured.

When removed from the toning bath, lay the print upon a glass plate and wash each side under a strong tap for a minute, and then lay it in a basin of clear water. When all the prints have been so treated, they must undergo a thorough and prolonged washing to remove from them every trace of Hypo, which would otherwise cause them rapidly to fade. This is best effected in running water. Place them in a deep dish on the bottom of the bath tub, and let a small stream run into it through a hose leading to the

bottom of the dish. In the country a cullender or basket placed in a running stream of clear water answers the purpose. Six hours of running water is sufficient, but if this advantage cannot be had, they must be left to soak in clean water for at least twenty-four hours, the water being frequently changed—at least ten times.

They are then to be hung in the air to dry.

The foregoing method will be found the simplest in manipulation, and the most certain in its results of all methods of printing. Albumen paper is, in the opinion of the writer, far preferable to plain paper. It is managed with more certainty and economy, as fewer papers are spoiled, and the result is more satisfactory and beautiful.

Two more processes will be added subsequently, a little more difficult, but possessing features of attractive interest.

VI.—MOUNTING THE PROOFS.

This is an operation to be performed with great care and neatness. The best photograph never appears to advantage until mounted on card board, and never at all if mounted in a careless or slovenly manner.

Plain paper prints are much more durable if protected against atmospheric action. Perhaps the most effectual way to accomplish this is the following:

Lay the print face downwards upon a plate glass, and rub the back strongly with a smooth ivory folder or a book-binder's burnisher. This will close the texture of the paper and sharpen the lines of the picture. Dissolve a lump of white wax in spirits of turpentine to a thin paste. Lay the print upon a glass and apply the wax paste to the face of it with a common paint brush; then holding it down firmly at one edge wipe off the superfluous quantity with a piece of linen rag. Do this by passes in one direction from the point where you hold it, or you are in danger of doubling the paper and badly cracking it. In a few hours the turpentine will evaporate. The picture may be mounted at once, and when dry, the surface rubbed with a silk handkerchief.

Printers' card board is a good material for mounting pictures. It is to be procured in sheets at $1 per dozen, which cut into six pieces sufficiently large for the purpose.

Never use flour paste or any other that will acidulate: it would cause your pictures to fade rapidly. The best substances for the purpose are white of egg, pure white starch made into a thick paste, or a mixture of gumarabic and gelatine dissolved in hot water to the consistency of molasses. If the latter be used put a few drops of oil of cloves in the bottle to prevent mould.

Having neatly trimmed the edges of your prints, lay each upon a card board and make two small pencil marks

against two of the sides, to indicate centrality. With a damp sponge pass over the face of the card board. Use a large brush to spread the paste over the back of your print so that it may be rapidly covered and laid upon the card board before the paste shall have time to soften the paper. Lay it to the marks and rub it smoothly down under a sheet of paper, with an ivory folder. Put it under pressure immediately, and if left unmoved until perfectly dry, it will remain flat.

We will now add a description of two more Printing Processes, and the French Toning Process, by Sel D'or.

I.—THE AMMONIO-NITRATE PROCESS.

This is a highly sensitive process on plain paper, very extensively practised, which under the gold coloring bath produces intense blacks and very clear high lights.

The paper is salted in the manner before described, but in a weaker solution of Chloride, as follows:

Chloride of Sodium, - -	60 grains.
Gelatine, - - - -	12 grains.
Water, - - - -	12 ounces.

The Ammonio-Nitrate of Silver used to sensitize the paper, is made as follows:

Dissolve 120 grains of Nitrate of Silver in one ounce of distilled water.

Into this solution pour, drop by drop, the strongest Aqua Ammoniæ. At first a heavy brown precipitate is thrown down, which is gradually re-dissolved as the addition of the Ammonia is continued. Shake or stir the solution at frequent intervals, and add the Ammonia more cautiously as it clears up. *As excess of Ammonia beyond the exact re-solution of the brown precipitate is very injurious to the result*, it is better to stop short of perfect clearness in the liquid. Then add another ounce of distilled water, filter the solution and keep it in a black vial.

Ammonio-Nitrate of Silver decomposes rapidly on the introduction of organic matter. The papers are not, therefore, floated upon it as in other processes. It is advisable to make it in small quantities.

Upon a board a few inches longer than your sheet of paper lay a sheet of blotting paper, and upon it the sheet of paper to be sensitised. Turn a little of the edge of this over the edge of the board and fasten it with a pin at each corner. Pour a small quantity of the solution into a saucer, and with a broad brush, such as is an appendage to a merchant's copying press, or with a twist of clean raw cotton, proceed to thoroughly wet the sheet over the entire

surface, taking care, by drawing the brush in crossing lines, that this is done as evenly as possible. When well wet, disengage it from the board and hang it up to dry. It should be used as soon as possible after it is perfectly dry, as it will soon blacken even in the dark.

Under exposure the paper assumes a dark slate blue color, and in the toning bath passes through a violet to an intense black.

Albumenised paper is not coagulated by Ammonia-Nitrate as it is by plain Nitrate of Silver. This process is, therefore, commonly used with plain paper only; it may, however, be applied to Albumenised paper by adding to the Ammonio-Nitrate solution (which must be made in a sufficient quantity) fifty per cent. of Alcohol, and floating the papers as before described. The Albumen is instantly coagulated by the Alcohol, and the paper will become sufficiently sensitive in 30 to 40 seconds. The result in printing is a rich dark purple black. The method is a wasteful one, however, as the solution rapidly loses its best qualities.

II.—PRINTING BY DEVELOPEMENT.

This very interesting process differs widely from the preceeding. The paper is exposed only until a faint image of the picture is impressed, which is afterwards deepened

by a developing agent. It is admirably adapted for use in the short dark days of winter, when the camera is laid upon the shelf. No toning bath is used, and prints produced by this method are reputed to be more permanent than any others.

It exacts the most scrupulous cleanliness in all the stages of its manipulation. The thin Hollingsworth (English) paper is recommended by the inventor, Mr. Sutton. The thin Saxe paper answers well.

1.—*Chloriding.*

Dissolve 60 grains of pure gelatine in 10 ounces of filtered rain or distilled water. In another 10 ounces of water dissolve 400 grains pure Chloride of Barium. Mix the solutions and filter them. Immerse the papers one by one with care that no air bubbles are caught under the sheets. After five minutes immersion turn the pile over, take them out separately and hang them up to dry. This chloriding solution will become mouldy in a few days, so it is well at once to prepare all the papers that are needed for a long period, as they will keep any length of time.

2.—*Sensitising.*

The Nitrate Bath on which this paper is sensitised is made by the following formula:

Nitrite of Silver, - - - - -	40 grains.
Lemon Juice, - - - - - -	4 drops.
Distilled Water, - - - - -	1 ounce.

Make a sufficient quantity to fill the tray to at least a quarter of an inch depth.

The papers must be now prepared under the same caution against exposure to white light as is necessary in preparing sensitive plates,

Put the bottle containing the bath solution into hot water, also fill a large dish with hot water and set your small tray, which is to hold the silver solution in it, resting on two small pieces of glass. The object of this is to maintain the Nitrate Bath at a temperature sufficient to soften the gelatine on the surface of the paper—say at about 80 degrees. This is an important point.

Float each sheet for four minutes and hang them up to dry.

3.—*Exposure to Light.*

The exposure must be continued only until the entire picture is visible. This is generally accomplished when the uncovered edge has attained a salmon tint. As negatives vary in intensity this will not be a certain guide in all cases, but some observation will be necessary to ascertain the color which the margin should reach in each particular case, as it is well to know when the print has been sufficiently exposed without having to uncover it. In the dullest weather the time would hardly reach five minutes.

4.—*Developing.*

For this part of the process a *chemically clean tray* is absolutely essential. The least impurity will cause a stain at the point of contact. To avoid the necessity of multiplying apparatus and keeping trays for this purpose specially, construct temporary ones out of paper. A half sheet of highly calendered packet post or cap paper will answer the purpose. Lay a glass of the proper size upon the sheet of paper as a measure, and turn up the edges all round, pinching the corners with the wooden clips. Take out the glass and put it under the paper to sustain it. This will hold water for half an hour or more without leaking. A sheet of paper pressed into one of your developing frames or gutta percha trays will answer the same purpose.

Make a saturated solution of Gallic Acid in distilled or rain water, and filter it carefully. It is probable that in most cases pure spring or river water would suffice, but the print is in this part of the process so extremely sensitive to the least chemical impurity of the materials and vessels used, that it is safest to use distilled or rain water.

Lay the picture in one of your paper trays and cover the face of it with the solution of Gallic Acid—the lines of the subject rapidly start out in a brilliant red color, almost a vermillion tint. If the exact time of exposure has been hit, the entire picture will attain a perfect developement in

this color, to the minutest of its details. It will then begin to darken to a sepia brown and finally, in about twenty minutes, it will have attained a rich reddish black, a very artistic and beautiful tone, resembling India ink mixed with deep lake.

5.—*Fixing.*

When the desired tone has been reached, remove the print from the Gallic Acid, wash each side under a tap, or lay it in clean water for two minutes.

Make a fresh solution of Hyposulphite of Soda, one ounce in twenty ounces of water. Cover the print with this solution in a tray and leave it immersed *just twenty minutes.* Fresh Hypo must be used for each print.

It must now be left in running water for three hours or in a tub of water changed ten times in twelve hours to remove the Hypo. When thoroughly washed, make it surface-dry by pressure between blotting papers and then dry it well before a fire.

III.—THE SEL D'OR TONING PROCESS.

By this method is attained the gray purple tint of the French photographs, finely shown in the landscapes of Blanquart Evrard of Lille. It is neither very difficult nor

troublesome in manipulation. It may be used with albumenized paper though with less certainty of result than with plain papers. The Saxe paper is the best for this method.

To Chloride the paper, float it upon the following solution:

Chloride of Ammonium,	80 grains.
Gelatine,	10 grains.
Water,	10 ounces.

Let it remain on this only until it becomes quite flat.

Sensitize it by floating one minute on a solution of Nitrate of Silver, fifty grains to the ounce of water, or with Ammonio-Nitrate brushed on as before described.

Expose to light only until the light parts of the picture are brought to exactly the depth they are to remain when the picture is finished, as the fixing bath does not reduce their intensity as in other processes.

It is now an object to remove from the paper every trace of free Nitrate of Silver, (that is, of the Nitrate of Silver that has remained upon the texture of the paper without being converted into Chloride of Silver.) This is the most important point in the process, for if any trace of Nitrate of Silver remains, the light parts of the picture will turn yellow and its beauty entirely disappear in the fixing solution. Proceed as follows: Immerse the prints face downward, in a basin of water covered with a board to exclude

the light. After ten minutes add a teaspoonfull of common salt to the water and leave them five minutes longer. Next lay them for one minute, or until they turn red in

Water, - - - - - - - - - - 1 pint.
Ammonia, - - - - - - - - - 1 dram.

On taking them from this, wash each one for a minute under a tap and lay them in a basin of clean water, covered from the light, while you prepare the toning solution.

Make a few ounces of solution of Hyposulphite of Soda, *one grain* of the salt to an ounce of water. In a few days this will become cloudy; it is then no longer fit to use.

Pour two ounces of this solution into a measuring glass and add one dram ($\frac{1}{2}$ grain) of your solution of Chloride of Gold. This is sufficient, when newly made, to tone six to ten pictures. It will decompose in a day or two.

Level a clean glass upon your levelling stand and lay the print face upward upon it. Pour on enough of the coloring solution to cover it, and watch the result. The red hue of the picture will pass in a few minutes to a delicate gray purple. When the tone is well developed do not continue the action of the toning solution longer, but pour it back into the measuring glass. Hold the plate and picture for a few minutes under a tap and then immerse the print for 10 minutes in

Hyposulphite of Soda, - - - 1 oz.
Water, - - - - - 6 oz.

If the removal of the free Nitrate of Silver has been properly effected the tone of the picture will not change in the fixing solution, otherwise it will fade.

Lastly, the print must be washed in the manner before described.

The foregoing comprise the methods of printing and toning most generally used. When the amateur has mastered these, he will be well prepared for experiment upon others—the field being, as before stated, a most attractive one.

POSITIVES ON GLASS.

Albumen positives on glass are viewed as transparencies, being backed by a surface of ground glass, or a coating of white wax. They are made in the following manner:

The glass must be of better quality than that used for negatives; free from scratches or bubbles, and perfectly flat.

Clean the plate with great care, and coat it in the same manner as if it were to be used in the Camera.

Fold your velvet focussing-cloth, or any piece of soft black stuff, to a little more than double the size of your plate. Lay one-half of the cloth so folded, over one of your developing trays, and press the prepared glass into it,

the sensitive film up, so that the light is excluded by the cloth from the back and edges of the plate. Place the negative from which the picture is to be made in contact with the prepared plate, taking care to adjust it nicely without scratching either it or the sensitive film. Turn the other half of the cloth over the back of the negative, and the plate is ready for exposure. All this is of course done by yellow-light.

Carry the plate, so arranged, into the open air, and under the diffused light of the sky, *not in the sunlight*, uncover the back of the negative for one to five seconds, according to the intensity of your negative, or of the light.

Develope and fix the exposed plate precisely in the manner described for negatives, except that the development may be pushed a little more rapidly, by adding more silver at once, than in the former case. The picture does not appear in successive stages as in developing a plate exposed in the Camera, but faintly all at once. The *depth of color* desired, is the point at which to stop the development.

When finished, mount them against a ground glass, or grind the back with emory dust. The result is a very beautiful transparent picture, in a rich olive brown tint. Set in frames, they make beautiful lamp-shades. The better kind of Stereoscope slides, are made in this manner. They may also be used with the Magic Lantern.

To make small positives for the Magic Lantern, from large negatives, the use of a small Camera, with a double

APPARATUS.

A Camera, with single lens.

Tripod stand, Exposure Frames, Plate Box, for prepared plates.

Two porcelain or queensware trays, (one to be kept exclusively for solutions of Nitrate of Silver.)

Two gutta percha trays.

Dipping Bath, for Nitrate Bath, with dipper.

Three funnels, one to be used only for Nitrate of Silver.

Three measuring glasses—8 ounces, 4 ounces, 1 dram.

A funnel stand.

One quire German filtering paper.

One quire Joseph Paper, and 1 yard of Canton flannel for cleaning glass.

A levelling stand.

Two developing frames, or trays.

A spirit lamp.

A buffing vice, to hold glass when being cleaned.

A large earthenware dish, about 10 by 12 inches.

A box of Apothecary's scales and weights, with a small horn spoon.

A glass stirring rod.

A supply of Glass for Negatives.

Most of these articles can be had cheaply at any store of Chemist's Ware, and all can be purchased at the Photographic Depots.

CHEMICALS.

Nitrate of Silver,	½ pound.
Iodide of Ammonium,	1 ounce.
Bromide of Ammonium,	½ ounce.
Alcohol,	1 quart.
Acetic Acid, No. 8,	½ pound.
Sulphuric Acid,	2 ounces.
Aqua Ammoniæ,	4 ounces.
Gallic Acid,	1 ounce.
Hyposulphite of Soda,	1 pound.
Chloride of Ammonium,	2 ounces.
Chloride of Barium,	1 ounce.
Cyanide of Potassium,	2 ounces.
Chloride of Gold,	15 grains.
Gelatine and Gum Arabic,	1 oz. each.

Nitric Acid, ½ pound, for cleaning Glass.

Everything in the Laboratory, should be conspicuously labelled.

The quantities specified in the foregoing Schedule of Chemicals are sufficient for several month's active practice

of the art. The writer recommends the Chemicals having the seals of Rosengarten & Son, and Powers & Weightman, as equal to the best to be obtained, and needing no test of their purity.

CONCLUDING MAXIMS.

Photography will yield no satisfactory results to a careless or indifferent operator. You deal with almost infinitissimal quantities, and with nice conditions of which Nature exacts the strictest fulfilment. The art demands the exercise of the habits of method, nicety and cleanliness, and the virtues of patience and perseverance—and is worthy of them. Its practice leads to a closer observation, and an increased enjoyment of all that is beautiful in Nature, and educates the eye i that knowledge of what is *truthful*, which is the basis of all sound judgment and true appreciation of art.

To the man of business this word of caution may not be superfluous. The art is a fascinating one; turn to it only in hours of leisure that have been fairly earned.

Manual
of
Photography